



Department of Geology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Microbially Enhanced Hydrocarbon Recovery

Professor Bruce Fouke is the principal investigator of a new research program supported by the British Petroleum Energy Biosciences Institute (BP EBI) to increase the amount of oil that can be extracted from existing wells by using environmentally friendly microbes within their geological habitat to help recover residual oil and enhance production. The project will also investigate methods of *in situ* biorefining to improve oil field life cycle costs and reduce environmental impacts. The research team includes Wen-Tso Liu (Illinois Civil and Environmental Engineering and IGB), Roderick Mackie (Illinois Animal Sciences and IGB), Isaac Cann (Illinois Animal Sciences and IGB), Nathan Price (Illinois Biochemistry and IGB), Lee Deville (Illinois Mathematics), Terry Hazen (Lawrence Berkeley National



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Song, Sun Reveal Inner Inner Core

Many scientists have theorized that there is a second, deeper core buried within Earth's solid inner core. But now, for the first time, two Geology Department researchers have confirmed it, creating a three-dimensional model that shows the Earth's "inner inner core."

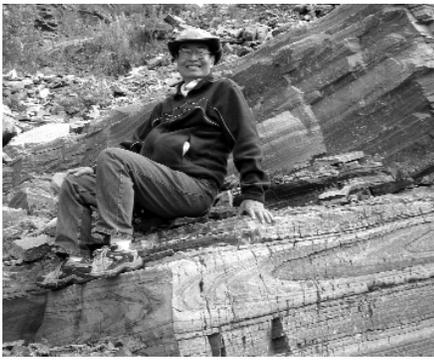
"For many years, we have been like blind men touching different parts of the elephant," says Professor Xiaodong Song. "Now we have a sense of the entire elephant and see what the inner core of Earth really looks like."

Using both current and long-standing data, Song and research associate Xinlei Sun painstakingly probed the shape of the Earth's core. The Earth's solid inner core, which is composed mainly of iron, is about 2,440 kilometers (1,525 miles) in diameter and plays an important role in the geodynamo that generates the Earth's magnetic field. What Sun and Song detected was the presence of an inner inner core of about 1,180 kilometers (733 miles), slightly less than half the diameter of the inner core.

In addition to the two inner cores, the Earth also has a fluid outer core about 7,000 kilometers (4,350 miles) in diameter.

To detect and create an image of the inner core, Sun and Song studied seismic waves created by earthquakes and traveling in all directions through the Earth's core. According to the researchers, the core is elastically anisotropic, which means that seismic waves move at different speeds along different directions.

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Atop an outcrop at the Eidsvoll flagstone quarry, Saetra Nappe of the Norwegian Caledonides

GREETINGS

Letter From The Head

"As our case is new, so we must think anew, and act anew." (Abraham Lincoln, 1862)

When I wrote to you all last time, I was looking forward to Steve Marshak, my predecessor, returning to campus and resuming his tenure as Head. However, circumstances required Steve to step up to the challenge of being the Director of our School of Earth, Society and Environment last fall; so my one-year term as Acting Head has turned into a longer endeavor. Our sincere congratulations, Steve! In the past nine months, Steve has already put the School on a rapid path of growth and everyone in the Geology Department is committed to the synergy between the Department and the School.

One of the main reasons that I accepted the challenge of my current position is the fact that I knew that I can count on the unwavering support of all of you—our alumni and friends. This notion has been borne out in that in spite of the global economic crisis, gifts to the Department continue to grow and a number of you visited campus in the recent past. On behalf of the Department, I thank you so much for your dedication to our core mission of education, research, public engagement, and economic development.

Since 2007, our annual Research Review which showcases student's work

has become a School-wide activity (Earth Research Review). Students from Geology continue to be the main driving force of this event and several new features were added in 2008. For the first time, we invited eight prospective graduate students to this event so they can observe firsthand the focus we place on students and how students interacts with each other and the faculty. The result is that eleven new graduate students will join the Department next fall. Jack Liu, a cofounder of Isotech Laboratories and an alumnus, represented his company at the Review to present the Isotech Student Research Awards. This year, there were three awards for each of the three departments in the School. In addition, there was a photo contest open to all and the Department offered cash prizes for the top three student entries.

Last year, our undergraduates established the first AAPG student Chapter on campus. For the juniors and seniors going to field camp this summer, they are stopping at Dinosaur Ridge near Denver, a wonderful research and educational facility instigated by Norb Cygan (see article in last year's newsletter). To compete for the best and the brightest of the next generation of geoscientists, we are using internal recourses to raise the stipend of all graduate assistants by \$3,000 per academic year; much of which is a direct result of your generous support over the years.

After change of administration both at the Federal and State levels, new opportunities for geosciences beckon. For instance, NSF is formulating a new, national initiative on the Dynamic Earth, with emphasis on both surficial and deep-seated processes and the links among them; and DOE just announced an agreement with the FutureGen Alliance that advances the construction of the first commercial scale, fully integrated, carbon capture and sequestration pro-

ject in the country in Mattoon, Illinois. Under this backdrop, we are in the process of expanding our collaborations with the State Surveys on issues of mutual concern, such as global changes and sustainability, in order to better compete for new resources.

To this end, all four Surveys are now part of the campus system under the new Institute of Natural Resource Sustainability. In fact, one faculty already succeeded in attracting a large new grant in conjunction with the Energy Biosciences Institute—the only major award to UIUC this year from a joint venture among BP, UC Berkeley, Lawrence Berkeley National Lab, and UIUC.

You may have heard that the Blue Waters Project has broken ground earlier this year on campus. This is the next generation of supercomputers, capable of performing 10^{15} floating-point calculations per second (peta-scale computing) and should come on-line in 2011. There will be only one such facility (so-called Track-1) for academia in the whole country and this project presents a major advantage for all of us at Illinois. High-performance computing is one of the areas where we are aggressively seeking approval for new hires, which are now under the direct control of the Provosts, so we can become a leader in computational geosciences and geo-informatics.

As this issue is being printed, we just concluded another successful joint Illinois-Indiana (UI-IU) reception at the AAPG meeting in Denver. I'm now looking forward to our next gathering which will be held in conjunction with the next GSA meeting in Portland next October. Please enjoy reading this issue and stay in touch. Finally, I hope that you had fun figuring out the geologic structure in the photograph.

Best wishes,
Wang-Ping Chen

Year in Review is published once a year by the Department of Geology, University of Illinois Urbana-Champaign, to highlight the activities and accomplishments within our department and feature news from our alumni and friends.

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Note from the editor: We changed the name of the newsletter slightly to reflect the natural cycle of academia.



Fighting Dandruff and Monitoring Oceans

Not as strange a combination as one might think.

It turns out that an ingredient in dandruff shampoo contains more potential than just clearing up scalp problems—it also may help unlock secrets of the oceans and serve as a key indicator about the future of life.

Associate Professor Tom Johnson and other scientists at the University of Leicester in England are using selenium to investigate how the oxygen content of oceans has changed. The study—the first attempt by scientists to use the element in this way— involves measuring isotopic ratios of

selenium in sediment. Selenium is a nutrient and antioxidant.

The work could provide information about an ocean's changing oxygen content, which indicates "overall health" of oceans, according to the University of Leicester. Some evidence indicates changing fish populations are associated with variations in oxygen levels in the oceans.

Determining the oxygen content of oceans has historically been very difficult. The scientists are using samples from the Venezuelan coast, where oxy-

gen levels have changed during the past 500,000 years, according to Andrew Shore, a PhD student at the University of Leicester. He began this research while studying a year abroad at the University of Illinois.

Shore and Johnson are also working with Gawen Jenkin at Leicester. The work is funded by the Petroleum Research Fund of the American Chemical Society.

Reprinted from LAS News Online, October 2008.

Microbially Enhanced Hydrocarbon Recovery

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Laboratory) and John Coates (UC Berkeley Microbiology).

It is estimated that less than twenty percent of the oil reserves in a typical subsurface reservoir is extracted using primary recovery techniques. An effective MEHR program could recover another five to ten percent or more. Microorganisms grow as biofilms lining the surfaces of sedimentary rock grains, as well as "bacterioplankton" floating in the fluids that fill the rock pore space. These microbial communities can enhance oil recovery in a variety of ways, which include breaking down the molecular structure of crude oil and making it more fluid, producing carbon dioxide gas or biomass that displace the oil, and by creating biosurfactants that behave like slippery detergents in moving the oil.

Among the program's "natural subsurface laboratories" will be a carbon sequestration injection well and associated monitoring wells in Decatur, Illinois, which are being drilled as part of a research program conducted by the Midwest Geological Sequestration

Consortium, lead by the Illinois State Geological Survey, and funded by the U.S. Department of Energy's National Energy Technology Laboratory (<http://www.sequestration.org>). Fouke's team of researchers will study the genetic makeup of microbial communities found in the formation water and rock samples extracted from the wells, and then quantitatively link their metabolic activity and distribution to the environmental and geological conditions of the subsurface.

The research team will analyze the environmental and geological conditions of shallower Paleozoic hydrocarbon reservoirs in addition to the deeper Cambrian CO₂ sequestration saline reservoir target. This includes water and rock geochemistry and hydrocarbon composition and will chart the geologic thermal burial history of each sample. Then they will determine the genetic spread and profiles of the subsurface microbes, including bacterial and viral communities, under various physical and chemical conditions.

Song, Sun Reveal Inner Inner Core

(continued from page 1)

However, they found there was a distinct change in the inner core's anisotropy, clearly marking the presence of a deeper, inner inner core.

"The inner inner core may be composed of a different phase of crystalline iron than the inner core, or it may have a different pattern of alignment," Sun says.

"This is the first time we have been able to piece everything together to create a three-dimensional view of the inner core," Song adds. "This view should help us better understand the character, mineral properties, and evolution of Earth's inner core."

Reprinted from LAS News Online, May 2008.

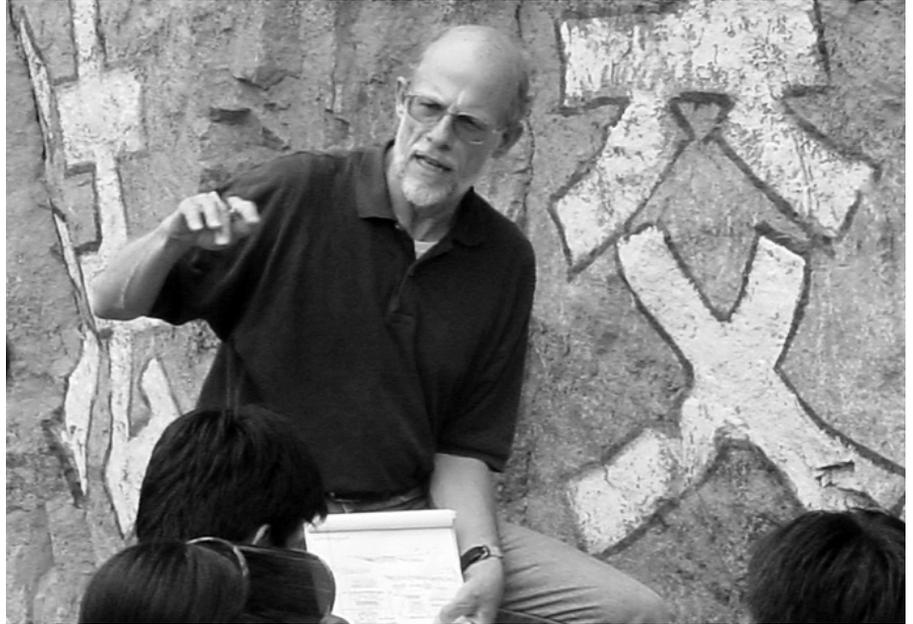
Leetaru, Ettensohn Receive Award

Two alumni were selected to receive the 2008 Outstanding Educator Award given by the Eastern Section of the American Association of Petroleum Geologists (AAPG).

For twenty years, Hannes E. Leetaru (PhD '97) has been a petroleum geologist at the Illinois State Geological Survey where his research interests include carbon sequestration and sequence stratigraphy. In 1997, he completed his dissertation entitled "Sequence stratigraphy and resource assessment of Aux Vases Sandstone in Illinois." Since then, he has been an adjunct faculty member of the Department teaching a graduate course in petroleum geology.

In addition to teaching students at Illinois, Leetaru organized a 2002 AAPG Summit on the Education of future petroleum geologists. Two publications were inspired by this meeting: Leetaru's "Teaching Sets in Petroleum Geology" and Stephen Bend's "Petroleum Geology eTextbook."

Leetaru has been very active in the Eastern Section of the AAPG, having held the offices of president, vice president, treasurer, and secretary. In addi-



Dr. Frank Ettensohn teaches Chinese geology students in the field at Ye San Po, China

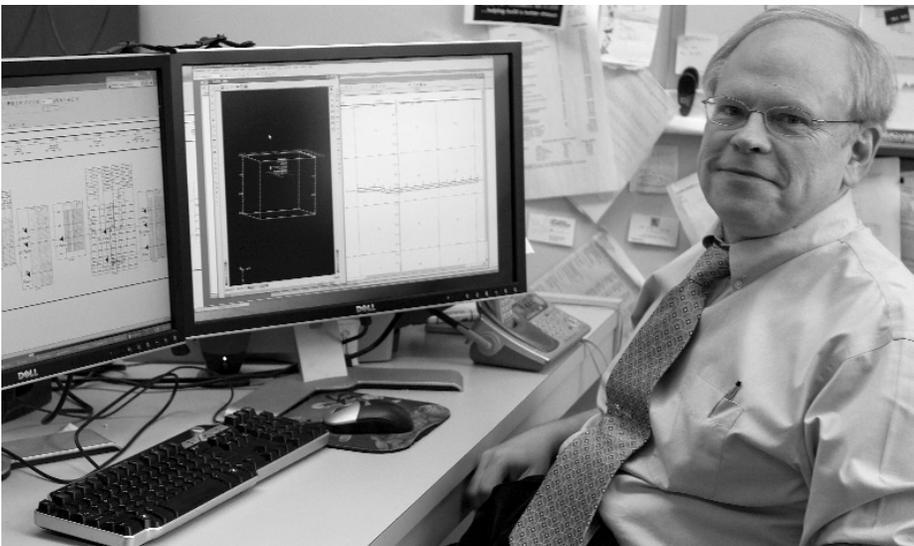
tion to a doctorate from Illinois, Leetaru holds degrees from the State University of New York at Fredonia and Syracuse University. Before working at ISGS, he was employed by Getty Oil as well as Union Pacific Resources as an exploration geologist.

Frank R. Ettensohn (PhD '75) has taught at the University of Kentucky for 34 years, during which time he served as department chair for eight years. In addition to teaching traditional geology courses, Ettensohn has been involved with curriculum development, including training for middle-school teachers in the earth sciences and experimental general education courses. In 2008, Ettensohn was named director of the University of Kentucky Honors Program.

Ettensohn has also served as a Fulbright Lecturer or visiting professor at universities around the world, including Nepal, China, Ecuador, and the Soviet Union.

While pursuing his dissertation at Illinois titled, "Stratigraphic and Paleoenvironmental Aspects of Upper Mississippian Rocks (Newman Group), East-Central Kentucky," Ettensohn worked with Dan Blake, Albert Carozzi, George Klein, and Ralph Langenheim.

In addition to his doctorate from Illinois, Ettensohn holds degrees from the University of Cincinnati.



Dr. Hannes Leetaru of the Illinois State Geological Survey.



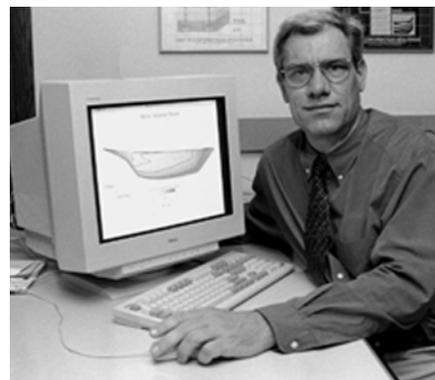
Three Professors Named to Endowed Positions



James Best



Jay Bass



Craig Bethke

The Geology Department had the honor of bestowing endowed professorships to three of its professors in the past two years.

In April 2007, Best was named the **Threet Professor of Geology**.

Professor Best's research interests include sedimentology and stratigraphy and in 2007-2008 he taught the field course "The Geology of County Clare, Western Eire: Sedimentology, Paleocology and Evolution of a Sedimentary Basin." Nearly forty students participated in this course.

The Threet Professorship was established by and honors alumni Jack C. Threet and Richard L. Threet.

Jack C. Threet earned his B.A. in Geology, Phi Beta Kappa, from the Department in 1951. Mr. Threet then undertook graduate work in geology under the mentoring of Prof. Harold Scott. Except for serving two years in the Army during the Korean War, Mr. Threet worked over 36 years for Shell, retiring in 1987 as Corporate Vice-President and Head of Exploration. Teams which he led found major oil and gas fields, many in frontier settings, such as deep water Gulf of Mexico, Syria, Cameroon, Malaysia, Australia and Brazil.

He served for many years on the Department of Geology's GeoThrust Committee. It was while serving on this committee that Mr. Threet gained first-hand knowledge of the needs for, and value of, endowed funds for educators, programs and projects in Geology at the University of Illinois.

After serving in the Marines during World War II, Richard L. Threet earned both B.S. and M.S. degrees in geology. His thesis research, under Professor Jack Hough (see story on p. 8), concerned Lake Ontario. He received his doctorate in structural geology and geomorphology from the University of Washington.

In February 2008, Jay Bass and Craig Bethke were named **Ralph E. Grim Professors of Geology**.

Professor Bass' research includes geophysics, high-pressure mineral physics, mineralogy, and ceramic engineering. He has served as president of COMPRES (Consortium for Materials Properties Research in Earth Sciences) and now serves on its executive committee. He teaches courses on the Geology of National Parks and Monuments, geophysics, and petrology of the earth's interior, among others.

Professor Bethke is a hydrogeologist specializing in mathematical modeling of subsurface and surficial processes, including fluid migration within sedimentary basins, chemical interactions between fluids and sediments, environmental aspects of aqueous geochemistry, and geomicrobiology. He teaches courses in hydrogeology and geochemical reaction analysis.

The Grim Professorship was established in 1977 through the generosity of Professor Emeritus Ralph Early Grim and his wife, Frances. Professor and Mrs. Grim provided initial funding for this position, which has grown through additional gifts to become an endowed professorship.

Professor Grim began his career as a petrographer at the Illinois State Geological Survey from 1931-1950. He became a research professor in the Department of Geology from 1948 until his retirement in 1967. Professor Grim is generally viewed as the founding father of clay mineralogy, and was one of the most distinguished faculty members to have been a member of the Geology Department.

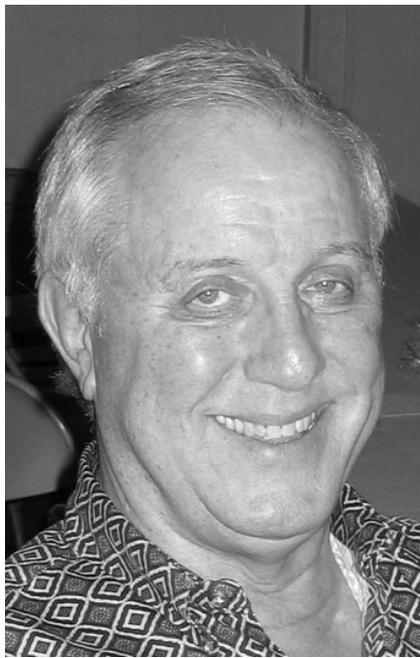
Soderman Receives Alumni Achievement Award

J. William Soderman (MS '60; PhD '62) is the 2008 Department of Geology Alumni Achievement Award winner. Soderman, who lives in Texas, has enjoyed a successful career as a geologist and manager working in oil and gas exploration.

After earning an undergraduate degree in geology at Columbia College, Soderman came to Illinois to earn his master's and Ph.D. His area of research was petrographic studies of carbonate rock sequences to understand genesis, alteration, and paleoenvironmental depositional conditions. His advisor was A.V. Carozzi and his research at Illinois was supported by the Petroleum Research Fund.

Upon graduation, Soderman was employed by Texaco, Inc. where he worked for the next sixteen years exploring for oil and natural gas and overseeing a broad range of research studies from oil generation and structural geologic research to bidding strategy for offshore lease sales in the Gulf of Mexico.

When he moved to Monsanto Oil Company in 1978, Soderman quickly rose through the ranks to become the Vice President for Worldwide Exploration, where he managed offices in the U.S., Canada, Argentina, Colombia, and England. In 1986, Monsanto Oil Company was purchased by BHP and merged with another company to form BHP Petroleum (Americas). After the sale, Soderman was installed as the Vice President for Exploration and New Ventures in North and South America.



It was also in 1986 that Soderman became involved in the GeoThrust Committee, a group of active and dedicated alumni who coordinate fundraising efforts on behalf of the Department. He has been involved ever since and now chairs the committee.

In 1991, Soderman began working as a vice president at British Gas and it was from there that he retired in 1993. Since that time, he has turned his attention to local education programs about wetlands and natural science for middle-school children, as well as supporting a scholarship program for community college students who are transferring to four-year institutions. He also served on an advisory council and technical committee of the Coastal Texas 2020 initiative sponsored by the Texas General Land Office. This initiative is looking closely at the impact of and possible solutions to dramatic beach erosion, rising sea levels, increased shoreline

development, as well as natural threats posed by hurricanes and tropical storms.

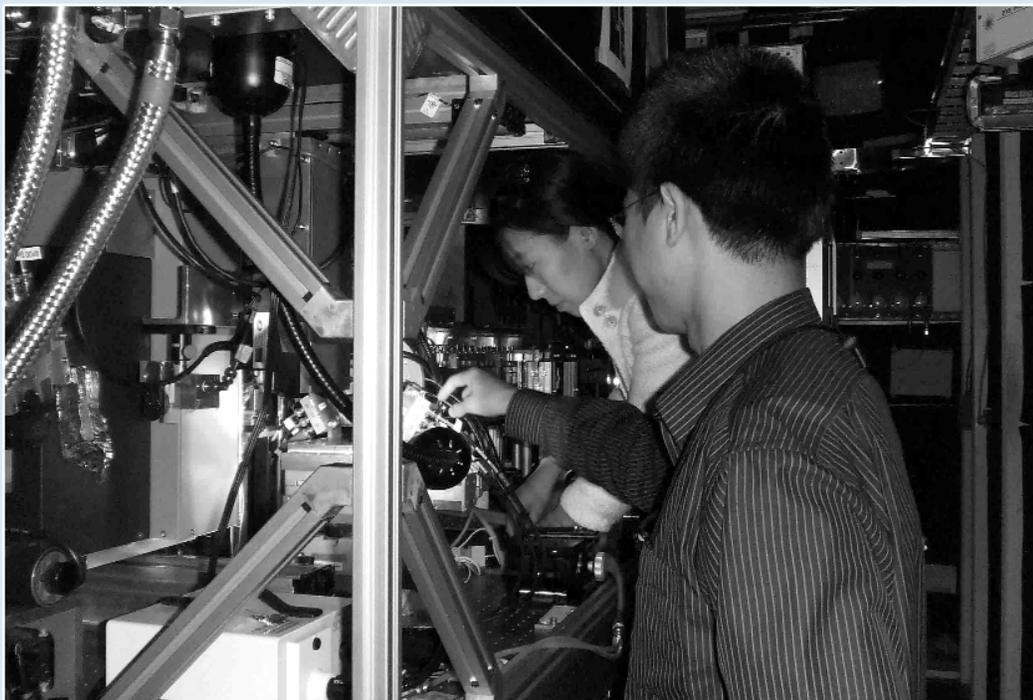
“During my professional career I combined business skills, scientific knowledge and intuition and a lot of hard work to achieve significant results for my employers and non-profit entities. It has been a very fulfilling career and life! Periodic visits to the Geology Department over the years reinforce my scientific knowledge and stimulate my interests. My continuing support stems from the belief that one should give back meaningfully to advance the institutions that helped build one’s abilities, and to allow others to have the same experiences.”

“Bill is a deep thinker—always anchored in logic and science—who has a wide-range of interests and talents. Whatever he does, you can count on getting good results,” said Department Head and Professor Wang-Ping Chen.

Soderman came to campus in February 2009 to receive his award and to give a lecture during the annual research review. His presentation was titled “Rocks around the Clock and a Million Frequent Flyer Miles.”



In the Field



Ph.D. Students Bin Chen and LiLi Gao working at the Advanced Photon Source, Argonne National Laboratory



Professors Craig Bethke and Craig Lundstrom stand on Musselman Arch (technically a natural bridge) over a side canyon of the Colorado River gorge, in the Island In The Sky area of Canyonlands National Park. They visited the park in May 2008, on a four-day mountain bike trip. Bethke said, "Musselman Arch is 6 feet wide, 5 feet thick, and 300 feet down, so my knees were shaking!"

Jack Hough: Pioneer Great Lakes Oceanographer

by Ralph L. Langenheim

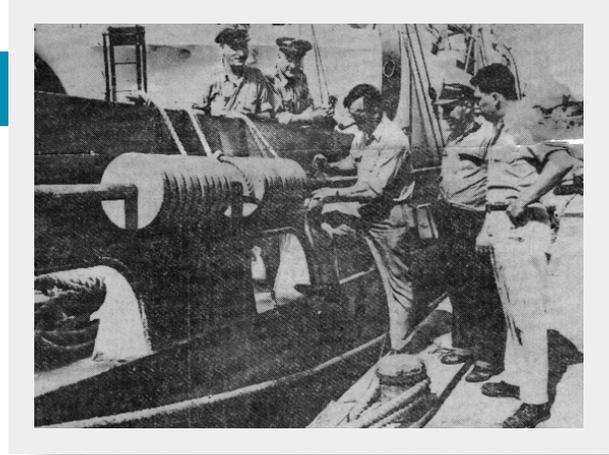
Editor's Note: "Windows into the Past" is a regular feature of the Year in Review contributed by Professor Emeritus Ralph L. Langenheim. Ralph's writing represents a long-serving faculty member's recollections and his perspectives of the Department's past.

When Jack Hough came to Illinois in 1947, he represented a new breed of oceanographers; men recruited and trained for government research, largely concerned with submarine warfare. Although "gentlemen yachtsmen" still persisted, oceanography changed dramatically during and after the Second World War. Playing by the new rules, Hough concentrated his oceanographic research in the Great Lakes, winning fame when he won the Geological Society of America's Kirk Bryan Award in 1959 for "the paper of greatest distinction advancing the science of geomorphology or some related field." The prize was all of \$200.00! As a Sigma Xi lecturer, during October, 1962, Hough spoke twenty-two times in New York and New England on "Prehistoric Great Lakes of North America." Also, he was frequently called as an expert witness in lawsuits and hearings regarding Chicago's use, and diversion of, Lake Michigan water.

Hough received his MS (1934) and PhD (1940) at the University of Chicago under Francis Pettijohn. He was first employed by the Soil Conservation Service from 1935 to 1941. Thereafter, he worked for Humble Oil and Gas, the Naval Bureau of Ordnance, Woods Hole Oceanographic Institution, and Standard Oil. Finally, he served as oceanographic and submarine geologist on the last Byrd Expedition to the Antarctic, Operation High Jump in 1947.

Although Illinois appointed Hough primarily as a petroleum geologist, he "rapidly and successfully" advanced work on engineering geology and established a course, Geology for Engineers and a Field Geology course at Baraboo, Wisconsin. In 1961-62 Hough revived the graduate course Geological Oceanography, and began organizing a cooperative Oceanography and Limnology curriculum with the University of Michigan. He supervised fifty-one Illinois theses; including twenty on subsurface petroleum geology, fifteen on sedimentary petrography and fifteen on Great Lakes geology. His thirty-one published papers at Illinois include nineteen on Great Lakes geology. In addition, he served as editor of the *Journal of Sedimentary Petrology* from 1951 through 1960, increasing its length from 241 to 634 pages.

Hough was granted leave from the faculty between January 1954 and December 1955 to accept an appointment as Head of the Department of Geology and Geophysics at the Indian Institute of Technology at Kharagpur, India: sponsored by the Indian Government and the United States State Department. Hough and his family left Urbana on February 15, 1955 and arrived in Kharagpur on March 18, 1955—at the beginning of the hot season. His job was to establish and equip a modern Department of Geology and Geophysics, recruit a qualified staff, establish a research library, organize a graduate curriculum, and recruit students for an "Agricultural M. I. T." in India. He soon reported that he "met with frustration in almost every activity" in both professional and personal routine operations. In



Jack Hough, graduate student Max Silverman and their sediment coring device on the Coast Guard Cutter, 'Woodbine,' August 1950. Image from a newspaper clipping presumably from Grand Haven, Michigan.

addition his young daughter failed to "adjust to the environment" in a succession of schools. Finally, he found that: "the job I came to do already has been done." Indeed, a well-organized, highly-qualified faculty of five teaching a suitable curriculum to academically superior students greeted him on arrival. He was left with ordering library materials and study collections. Therefore, he terminated his appointment in May 1955, took a leisurely trip home, and spent August doing field work in Canada.

After his return from India, he resumed his Great Lakes studies and increased Illinois' association with the University of Michigan. He spent the summer of 1958 at the University of Michigan Great Lakes Research Station. In 1964, Hough left Illinois to become a professor of oceanography at the University of Michigan. He was replaced by Adrian F. Richards.

A note from Ralph L. Langenheim:

This, and prior "Windows into the Past," essays are installments in a departmental history beginning with John Wesley Powell and Don Carlos Taft and ending around 1967 with George White's chairmanship.

Sources for this, and the seven preceding essays, include the University of Illinois Archives, Geology Departmental records, memorials and obituaries, citations for professional honors, newspaper files, departmental newsletters, and the departmental scrapbook.



Around the Department

Professor **Steve Marshak** has been named director of the School of Earth, Society, and the Environment (SESE) at Illinois. This new School was established in 2007 and encompasses the departments of Geology, Geography, and Atmospheric Sciences. Succeeding Marshak as Head of the Department is Professor **Wang-Ping Chen**.

Professor **Chu-Yung Chen**, Associate Head of the Department since 2005, was promoted to the Director of Educational Affairs for Geology, effective August 2008. She will continue administering all instructional activities and student affairs in the Department.

Lura Joseph, Geology and Digital Projects Librarian, was presented with the 2008 GeoScience Information Society Best Paper Award for her paper titled, "Comparison of Retrieval

Performance of Eleven Online Indexes Containing Information Related to Quaternary Research, an Interdisciplinary Science" published in *Reference and User Services Quarterly*. Joseph also won the Best Paper Award in 2007.

Gary Parker received the Lifetime Achievement Award from the International Association of Hydrology Engineering and Research.

Professor **Craig Bethke** published *Geochemical and Biogeochemical Reaction Modeling* in January 2008. Published by Cambridge University Press, the book provides a comprehensive overview of reaction processes in the Earth's crust and on its surface, both in the laboratory and in the field. In *Mineralogical Magazine*, David Manning called the book, "an extremely valuable

resource. It provides an essential basis for understanding the chemical behaviour of waters in natural systems." The book can be used as a companion to The Geochemist's Workbench, modeling software developed by Bethke and already used at over 1000 universities and research facilities worldwide.

In June 2008, Assistant Professor **Jie Li** was a keynote speaker at the COMPRES Annual Meeting in Colorado Springs, Colorado. Her talk was titled, "What can High-Pressure Experiments Tell us about the State and Evolution of Planetary Cores?" She also spent the summer as an instructor in the summer program at CIDER, the Cooperative Institute for Deep Earth Research. CIDER is located at the University of California, Santa Barbara.

Degrees Conferred in 2008

Bachelor of Science Degrees

May

Scott Goode
Kevin Hagen
Sara Hughes
Matthew Kyrias
Elizabeth Luber
Michael Peterson
Wesley Vermillion
Kelly Voigt

August

Gideon Bartov
Steven Burkhead
Gregory Durant
Clayton Karz
Philip Miller
Eric Obrock
Andrew Obuchowski
Lindsay Rathnow

December

Rebecca Binversie
Nicole Fox
Jenna Mortensen
David Ortiz

Master of Science Degrees

May

Alan Piggot, *Coral Cellular Response to Stress: Auto- to Heterotrophic Switching* (Bruce Fouke)

David Robison, *Reduction of Hexavalent Chromium Determined by Isotopic Fractionation in Groundwater Contamination Originating from Los Alamos National Laboratory* (Thomas Johnson)

August

Christopher Mead, *Mercury Isotope Analysis by Double Spike* (Thomas Johnson)

Kevin Wolfe, *A July-Temperature Record of the Past 2000 Years Inferred from Chironomid Assemblages at Hudson Lake, Alaska* (Feng Sheng Hu)

December

Peter Berger, *An Optimization Approach to Groundwater Age Dating: How Old Is Groundwater in the Paris Basin?* (Craig Bethke)

Daniela Lindner, *Inner Core Rotation and Its Variability from Non-Parametric Modeling* (Xiaodong Song)

Doctor of Philosophy Degrees

October

Jungho Park, *Microbial and Chemical Zonation and Mineral Weathering in the Middendorf Aquifer, South Carolina* (Craig Bethke)

December

Jingyun Wang, *The Effect of Hydration State, Fe, and Spin State of Fe on the Elasticity of Mantle Minerals at High Pressure* (Jay Bass)

Obituaries

William Back (AB '48) died January 31, 2008 at the age of 82. He spent forty-six years with the U.S. Geological Survey studying the chemistry and hydrology of the nation's groundwater systems.

James C. Bloom (BS '60) died February 27, 2008. No further information is available.

Anthony C. Kuhn (BS '83) died June 19, 2008 at the age of 48. He worked for the IRS for over two decades, holding positions in Kansas City, Cincinnati, and, most recently, Washington D.C.

Odell S. McGuire (PhD '62) died December 8, 2008 at the age of 81. He taught geology for thirty-two years at Washington and Lee University in Virginia.

Ruth Plain Wallace (AB '34) died January 29, 2008 at the age of 96. For many years she ran a nursery school in northern Illinois.

Norman Slama (BS '57) died April 22, 2008 at the age of 78. After serving in the Navy and Air Force during the Korean War in Japan and Korea, Slama earned his degree from Illinois. He worked his entire career at the U.S. Geological Survey, retiring in 1990 with 33 years of service.

H. James Spangler (BS '50) died May 16, 2008 at the age of 83. In 1986, he retired as an ombudsman for the Deputy for Procurement and Production at the U.S. Army Armament, Munitions and Chemical Command in Rock Island, Illinois.

Richard Stute (BS '50) died September 26, 2008 at the age of 79. He owned and operated the Sucker State Newspaper and printing shop in Mahomet, Illinois.

Charles Summerson (BS '38, MS '40, PhD '42) died April 28, 2008 at the age of 93. For thirty-five years, Summerson taught geology at The Ohio State University. In 1960 he

received a commendation from the U.S. Congress for his work in Antarctica; in addition, a mountain on the continent was named after him.

Harriet Wallace, geology librarian emerita, died on January 14, 2009. She was 94 years old. She served the geology library in the 1960s and 1970s. Wallace received her bachelor's degree in geology from Northwestern in 1936 and a master's degree in library and information science from Illinois in 1962. She was immediately hired as the geology librarian at Illinois and continued to serve in that role until her retirement in 1979. Over the years she has been a generous benefactor of the department, having established the Harriet Wallace Woman Graduate Student Prize.

1960s

Marion E. (Pat) Bickford (MS '58, PhD '60) received the 2008 Distinguished Service Award from the Geological Society of America.

1990s

Georg Grathoff (PhD '96) writes, "After I graduated I went to Portland State University as an assistant professor on a fixed term contract. I just recently accepted a permanent position at the University of Greifswald, in Germany. Greifswald is a small town with a prestigious university right on the Baltic Sea. I came to the U of I after earning my master's degree in Germany and now I have returned with my wife and two boys."

Lisa Whitenack (BS '99) just completed her Ph.D. in biology at the University of South Florida in December 2008. Her dissertation was

titled "The Biomechanics and Evolution of Shark Teeth." She remains at USF, where she has recently started a postdoctoral fellowship in geology.

2000s

Leslie (Savage) Condon (BS '04), and Robert Condon (MS '04) were married on March 8, 2008, in Deerfield Beach, Florida. Leslie works for a private facilities and environmental consulting firm in Fort Lauderdale, Florida. Rob works for a private geotechnical engineering firm in Miami Lakes, Florida. Rob and Leslie met in Professor Steve Marshak's Structural Geology course in the Fall of 2002.

Marynia Kolak (BS '06) has entered the MFA program in creative writing at Roosevelt University in Chicago. She notes that her background in geology "has essentially made me an investigator and go-getter with a very grounded, practical perspective" that she

knows will serve her well in grad school. Kolak is also volunteering for Engineers Without Borders, constructing a database of research on a site in Ghana. She hopes to travel with them within the next few years.

Melanie Mudarth (BS '06) is pursuing graduate studies in Chicago and is teaching Earth Science in Zion, Illinois, and "having a great time in a new environment."

Steven Burkhead (BS '08) is a hydrogeologist with EarthTech Aecom in California. He writes, "I am currently working on a major project with a team of four, investigating a TCE plume under a naval base near San Diego. My job so far has been to create detailed geologic cross sections based on monitoring well data and cpt logs so we know how to proceed with a remediation method."



Colloquium Speakers for Spring and Fall 2008

Spring 2008

January 18

John Vidale, University of Washington, Seattle
“Fault Tremor Ignited by Shaking from Distant Great Earthquakes: Examples from the San Andreas Fault System and Vancouver Island”

January 25

Cin-Ty Lee, Rice University
“Regulating Continent Growth and Composition by Chemical Weathering”
Ralph E. Grim Lecture

February 1

Jie Li, University of Illinois, Department of Geology
“Understanding Magnetism of Terrestrial Planets from High-Pressure Experiments”

February 8

Franklin W. Schwartz, 2007 Geology Alumni Achievement Award Recipient
“Climate Variability and Its Impacts on the Hydrology of Small Mid-Continent Lakes and Wetlands”
Buckley Lecture in Environmental Geology

February 15

Wang-Ping Chen, University of Illinois, Department of Geology
“From Continental Collision to the Earth’s Deep Water Cycle: Preliminary Synthesis of Results from Project Hi-CLIMB”

February 22

Kevin Finneran, University of Illinois, Department of Environmental Engineering
“Biological and Abiotic Reactions with Iron and Electron Shuttles that Promote hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) Degradation”

February 29

Ron Smith, Yale University
“Orographic Precipitation and Isotope Fractionation along the American Cordillera”
SESE Joint Colloquium

March 7

Chris Paola, University of Minnesota
“Sandbox Stratigraphy”
Lecture supported by the W. Hilton Johnson endowment

March 28

Richard Peltier, University of Toronto
“The Ice-Age Earth: Geodynamics and Climate Dynamics”

April 4

Charles Leshner, University of California, Davis
“Radiography and Computed Tomography at High Pressure: Applications to Mantle Melt Physics”
Ralph E. Grim Lecture in Mineralogy

April 11

Francesca Smith, Northwestern University
“Molecular Isotope Records of Plant Community Change across the Paleocene Eocene Thermal Maximum”

April 18

Mike McCurry, University of Idaho
“Volcanism of the Snake River Plain”
Walgreen Lecture

Fall 2008

August 29

Kaj Johnson, Indiana University
“Active Mountain Building Processes in Taiwan”

September 5

Anne Hofmeister, Washington University, St. Louis
“Geophysical Implications of New Measurements and Models of Thermal Transport from Crust to Core”

September 8 (Special Monday Talk)

John Clague, Simon Fraser University
“Earthquake Hazards and Risk in the Pacific Northwest”
GSA/AEG Richard H. Jahns Distinguished Lecturer in Engineering Geology, jointly sponsored by the Illinois State Geological Survey and the Department of Geology

September 12

Becky Mansfield, Ohio State University
“The Surprises of Property: Remaking Nature-Society Relations through Privatization”
School of Earth Society and the Environment (SESE) Colloquium

September 19

Debbie Thomas, Texas A&M University
“Deep-Ocean Circulation During Extremely Warm Climates”
Consortium for Ocean Leadership, U.S. Support Program Distinguished Lecturer

September 26

Joel Blum, University of Michigan
“Biogeochemistry of Mercury with New Insights from Mercury Stable Isotopes”
Glenn and Susan Buckley Lecture in Environmental Geology

October 3

Nicole Gasparini, Tulane University
“Network Scale Power-law Relationships for Estimating Sediment Flux and Bedrock Incision Rates”
Lecture supported by the W. Hilton Johnson endowment

October 10

Chris Pearson, National Geodetic Survey’s Geodetic Advisor for Illinois
“Correcting Survey Measurements in the Western U.S. for Tectonic Deformation”

October 17

Bill Inskeep, Montana State University
“High-temperature Chemotrophic Environments are Excellent Model Systems for Understanding Microbial Controls on Geochemical Cycling”
Richard L. Hay Lecture

October 24

Matt Fouch, Arizona State University
“EarthScope Explores the Depths of Western North America”
Earthscope Distinguished Lecturer Series

October 31

Lisa Morgan, U.S. Geological Survey
“Tracking the Yellowstone Hotspot: Evidence from Volcanism, Uplift and Faulting for a Mantle Plume Origin”
R. James Kirkpatrick Lecture

November 7

Allen Glazner, University of North Carolina, Chapel Hill
“Making Plutons a Bit at a Time and the Rarity of Large Magma Chambers”
Ralph E. Grim Lecture

November 14

Scott Elrick and John Nelson, Illinois State Geological Survey
“Evolution of a Peat-contemporaneous Channel and Origin of Split Coal, Springfield Coal, Pennsylvanian of Illinois Basin”

December 5

Ray Kostaschuk, University of Guelph
“Sediment Dynamics of Fluvial Trubidity Currents—Lillooet Lake, Canada”

Correction:

The 2007 Year in Review omitted a lecture from the Spring 2007 list of colloquia. On April 26, 2007, Dr. Norbert Cygan (BS '54, MS '56, PhD '62), career geologist in oil exploration, mineral exploration and education, presented “Oil Exploration in the Sudan: A Classic and Successful Program Terminated by Political Instability” and “Fifty Years Work as a Professional Geologist.”

We regret the error.

Faculty

Stephen Altaner (Associate Professor)
 Alison Anders (Assistant Professor)
 Jay Bass (Grim Professor)
 Jim Best (Threet Professor)
 Craig Bethke (Grim Professor)
 Chu-Yung Chen (Associate Professor)
 Wang-Ping Chen (Professor and Head, effective August 2008)
 Bruce Fouke (Associate Professor)
 Thomas Johnson (Associate Professor)
 Susan Kieffer (Walgreen Professor)
 Jie Li (Assistant Professor)
 Craig Lundstrom (Associate Professor)
 Steve Marshak (Professor and Head through July 2008)
 Gary Parker (Johnson Professor)
 Xiaodong Song (Professor)

Department Affiliate

Marcelo Garcia (Seiss Professor, Civil and Environmental Engineering)
 Feng Sheng Hu (Professor, Plant Biology)
 Bruce Rhoads (Professor and Head, Department of Geography)

Academic Staff, Post-Docs, Visiting Staff

Mariano Cantero (Post-Doctoral Research Associate)
 Pinaki Chakraborty (Post-Doctoral Research Associate)
 Rocio Fernandez (Post-Doctoral Research Associate)
 Justin Glessner (Geochemist)
 Eileen Herrstrom (Teaching Specialist)
 Stephen Hurst (Research Programmer/Geologist)
 Wonsuck, Kim (Post-Doc Research Associate)
 Ann Long (Teaching Specialist)
 Xinli Lu (Post-Doc Research Associate)
 Philip Parker (Visiting Research Programmer)
 Daniel Saalfeld (Visiting Research Programmer)
 Rob Sanford (Senior Research Scientist)
 Michael Stewart (Lecturer)
 Jonathan Tomkin (Research Assistant Professor)
 Tai-Lin Tseng (Post-Doctoral Research Associate)
 Hasan Yavas (Post-Doctoral Research Associate)
 Sharon Yeakel (Research Programmer)
 Zhaofeng Zhang (Visiting Scholar)

Adjunct Faculty

Robert Finley
 Leon R. Follmer
 Morris W. Leighton
 Hannes Leetaru
 William Shiels
 Wolfgang Sturhahn
 M. Scott Wilkerson

Emeritus Faculty

Thomas F. Anderson
 Daniel B. Blake
 Albert V. Carozzi
 Donald L. Graf
 Arthur F. Hagner
 Albert T. Hsui
 George D. Klein
 Ralph Langenheim
 C. John Mann
 Alberto Nieto
 Philip Sandberg

Library Staff

Lura Joseph (Librarian)
 Sheila McGowan (Library Assistant)
 Diana L. Walter (Senior Library Specialist)

Department Staff

Julie Dyar (Office Support Specialist)
 Marilyn Whalen (Office Administrator)

Graduate Students

Elizabeth Armstrong
 Gideon Bartov
 Anirban Basu
 Peter Berger
 Charles Bopp
 Bin Chen
 Mirona Chirienco
 Wei Dai
 Dong Ding
 Xing Ding
 Theodore Flynn
 Jared Freiburg
 Lili Gao
 Jessica Hellwig
 Carly Hill
 Ana Houseal
 Fang Huang
 Kevin Hughes
 Meijuan Jiang
 Matt Kyrias
 Xiaoxiao Li
 Daniela Lindner
 Vineeth Madhavan
 Chris Majerczyk
 Phillip Miller
 Charlie Mitsdarfer
 Mara Morgenstern
 Jessica Palmer
 Mauricio Perillo
 Justine Petras
 Amanda Raddatz
 Pragnyadipta Sen
 Derik Strattan
 Holly Vescogni
 Jingyun Wang
 Nathan Webb
 Kevin Wolfe
 Karen Wong
 Zhen Xu
 Zhaohui Yang
 Jin Zhang

COURSES TAUGHT IN 2008

GEOL 100 Planet Earth
 GEOL 101 Introductory Physical Geology
 GEOL 103 Planet Earth QRII
 GEOL 104 Geology of the National Parks
 GEOL 107 Physical Geology
 GEOL 110 Exploring Geology in the Field
 GEOL 117 The Oceans
 GEOL 118 Natural Disasters
 GEOL 143 History of Life
 GEOL 199 Undergraduate Open Seminar
 GEOL 208 History of the Earth System
 GEOL 333 Earth Materials and the Environment
 GEOL 380 Environmental Geology
 GEOL 390 Individual Study
 GEOL 391 Individual Honors Study
 GEOL 401 Geomorphology
 GEOL 406 Fluvial Geomorphology
 GEOL 411 Structural Geol and Tectonics
 GEOL 415 Field Geology
 GEOL 432 Mineralogy and Mineral Optics
 GEOL 436 Petrology and Petrography
 GEOL 440 Sedimentology and Stratigraphy
 GEOL 450 Physics of the Earth
 GEOL 452 Introduction to Geophysics
 GEOL 460 Geochemistry
 GEOL 470 Introduction to Hydrogeology
 GEOL 481 Earth Systems Modeling
 GEOL 497 Special Topics in Geology
 GEOL 497AB Geomicrobiology and Geochemistry
 GEOL 497AL1 Challenges of Sustainability
 GEOL 515 Advanced Field Geology
 GEOL 516 Continental Lithosphere
 GEOL 540 Petroleum Geology
 GEOL 554 Physics of Earth's Interior
 GEOL 562 Isotope Geology
 GEOL 563 Analytical Geochemistry
 GEOL 570 Hydrogeology
 GEOL 593 Advanced Studies in Geology
 GEOL 593A1 Integrated Grad Earth Science
 GEOL 593C2 Tectonic Geomorphology



Research Grants Active in 2008

AIR FORCE

Wang-Ping Chen—Frequency-dependent Characteristics of Regional Seismic Phases: Propagation of Pn in Western China.

Xiaodong Song—Surface Wave Dispersion Measurements and Tomography from Ambient Seismic Noise in China.

AMERICAN CHEMICAL SOCIETY

Jonathan Tomkin—The Effect of Late Cenozoic Glaciation on the Evolution of the Olympic Mountain.

ARGONNE NATIONAL LAB

Jay Bass—High Resolution Inelastic X-ray Scattering at High P & T: a New Capability for the COMPRES Community.

Jie Li—Proposal for Funding to Support Ph.D. Candidate Lili Gao.

Robert Sanford—Assessment of Anaerobic Metal Reducing Anaeromyxobacter Populations in DOE Relevant Radionuclide impacted Scenarios.

BATTELLE MEMORIAL INSTITUTE

James Best—Combined Multi-beam Echo Sounder and Acoustic Doppler Profiler Mapping of the Upper St. Clair River: Morphology, Grain Size, Bedload Transport Paths and Flow Dynamics.

CARNEGIE INSTITUTION OF WASHINGTON

Jie Li—Thermal Conductivity of High-pressure Ices and Iron-rich Phases Using Time-domain Thermo-reflectance Method and Diamond Anvil Cells.

CORNING INC. FOUNDATION

Jay Bass—Brillouin Scattering on Glasses.

DEPARTMENT OF ENERGY

Jay Bass—Aqueous Geochemistry at High Pressure and Temperature.

Thomas M. Johnson—Chromium Isotopes as Indicators of Hexavalent Chromium Reduction.

EXXONMOBILE

Gary Parker—Transport of Gravel by Turbidity Currents.

Gary Parker—Long Runout Turbidity Currents.

Gary Parker—Coastal Sedimentation.

LOUISIANA DEPARTMENT OF NATURAL RESOURCES

Gary Parker—Land Build Model: Mississippi Delta.

MWH AMERICAS INC.

Thomas M. Johnson—Stable Isotope Analysis.

MINNESOTA POLLUTION CONTROL AGENCY

Gary Parker—Sediment Flux Rates in Stream Channels.

NASA

Susan Kieffer—Multicomponent, Multiphase H₂O-CO₂ Thermodynamics and Fluid Dynamics on Mars.

Susan Kieffer—Thermodynamics and Fluid Dynamics in Multicomponent Systems Relevant to Enceladus.

Susan Kieffer—Simulation of the Effects of Vent Geometry and Canopy Interactions on the Plumes and Deposits on Io: UIUC Part of a Joint Proposal with UT.

Susan Kieffer—An Experimental Investigation of Conditions Conducive to Groove and Ridge Formation at Double-layer-ejecta (DLE) Craters on Mars.

Jie Li—Chemical Convection in Iron-Rich Planetary Cores.

NATIONAL SCIENCE FOUNDATION

Jay Bass—Workshop on Phase Transitions and Mantle Discontinuities.

Jay Bass—Sound Velocities and Elasticity of Deep-Earth Materials at High Pressures and Temperatures.

Jay Bass—Collaborative Research: Elasticity Grand Challenge of the COMPRES.

James Best and Fouke, Bruce W; Garcia, Marcelo Horacio; Parker, Gary; Rhoads, Bruce—Acquisition of a State-of-art, Shallow Water Multibeam Echo-sounding System at the University of Illinois at Urbana-Champaign (UIUC MBES).

James Best—Collaborative Research: A Field and Numerical Study of Morphology, Flow, Sedimentary Processes, and Stability of Sand-Bed Fluvial Bifurcations.

Wang-Ping Chen—Collaborative Research: Lithospheric-Scale Dynamics of Active Mountain Building Along the Himalayan-Tibetan Collision Zone.

Wang-Ping Chen—CSEDI Collaborative Research: A Study of Deep Subduction Integrating Broadband Seismology and Mineral Physics.

Wang-Ping Chen—Collaborative Research: Imaging the Continental Lithosphere with Earthquake Sources.

Bruce Fouke—Geobiological and the Emergence of Terraced Architecture During Carbonate Mineralization.

Thomas Johnson and Craig Lundstrom—Technical Support for the New Mc-ICP-MS Laboratory at University of Illinois.

Jie Li—Collaborative Research: Theoretical and Experimental Investigations on the Role of Iron in the Physics and Chemistry of the Lower Mantle.

Craig Lundstrom—Collaborative Research: Probing Mantle Plumbing Beneath Pacific Ridges Through Study of the Lamont and Vance Seamount Chains.

Gary Parker—STC: National Center for Earth-surface Dynamics

Xiaodong Song—CSEDI Collaborative Research: Observational and Theoretical Constraints on the Structure and Rotation of the Inner Core.

OFFICE OF NAVAL RESEARCH

Bruce Fouke and Milton McAllister—Microbiological, Physiological, and Toxicological Effects of Explosive Compounds on Coral Health.

Bruce Fouke—The Role of Shipyard Pollutants in Structuring Coral Reef Microbial Communities: Monitoring Environmental Change and the Potential Causes of Coral Disease.

THE RESEARCH FOUNDATION OF THE STATE UNIVERSITY OF NEW YORK

Jay D. Bass—High-Resolution Inelastic X-ray Scattering at High P & T: A New Capability for the COMPRES Community.

SCK CEN

Craig Bethke—Membership in the Hydro-Geology Program Industrial Consortium.

SHELL INTERNATIONAL EXPLORATION AND PRODUCTION

Gary Parker and Garcia Marcelo—Channelization by Turbidity Currents in Submarine Fairways and on Fans.

UK NATURAL ENVIRONMENT RESEARCH COUNCIL

James Best—Fluid Dynamics Across the Interface in Gravel-bed Rivers: Quantification and Numerical Modeling of Flow in the Hyporheic Zone.

US GEOLOGICAL SURVEY

Craig Bethke—Membership in the Hydro-geology Program Industrial Consortium for Research and Education.

Stephen Marshak—Mapping and Structural Analysis of the Leeds to Coxsackie Segment of the Hudson Valley Fold-Thrust Belt, New York.

LIST OF PUBLICATIONS FOR 2008

- Anders A.M., Roe G.H., Montgomery D.R. and Hallet B. Influence of precipitation phase on the form of mountain ranges. *Geology*, 36: 479-482.
- Baas J.H. and Best J.L. The dynamics of turbulent, transitional and laminar clay-laden flow over a fixed current ripple. *Sedimentology*, 55: 635-666, doi:10.1111/j.1365-3091.2007.00916.x
- Bass J.D. and Parise J.B. Deep Earth and recent developments in mineral physics. *Elements*, 4 (3), 157-163.
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- Best J.L. and Rhoads B.R. Sediment Transport, Bed Morphology and the Sedimentology of River Channel Confluences. In S.M. Rice, A. Roy and B.L. Rhoads (Eds.), *River Confluences, Tributaries and the Fluvial Network*, (pp. 45-72). Hoboken: Wiley and Sons.
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- Lauer J.W., Parker G. and Dietrich W.E. Response of the Strickland and Fly River confluence to post-glacial sea-level rise. *Journal of Geophysical Research Earth Surface*, 113: F01S06, 22 p.
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- Park J., Sanford R.A. and Bethke C.M. Microbial activity and chemical weathering in the Middendorf aquifer, South Carolina. *Chemical Geology*, 258: 232-241.
- Parker G., Muto T., Akamatsu Y., Dietrich W.E. and Lauer J.W. Unraveling the conundrum of river response to rising sea level: from laboratory to field. Part I. Laboratory experiments. *Sedimentology*, 55(6): 1643-1655.
- Parker G., Muto T., Akamatsu Y., Dietrich W.E. and Lauer J.W. Unraveling the conundrum of river



Publications continued

- response to rising sea level: from laboratory to field. Part II. The Fly-Strickland River System, Papua New Guinea. *Sedimentology*, 55(6): 1657-1686.
- Parsons D.R., Best J.L., Lane S.N., Kostachuk R., Hardy R.J., Orfeo O., Amsler M.L. and Szupiany R.N. Large River Confluences. In S.M. Rice, A. Roy and B.L. Rhoads (Eds.), *River Confluences, Tributaries and the Fluvial Network*, (pp. 73-91). Hoboken: Wiley and Sons.
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- Sikora E.R. and Johnson, T.M. Microbial mass-dependent fractionation of chromium isotopes. *Geochimica et Cosmochimica Acta*, 72: 3631-3641.
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- Sun X.L. and Song X.D. The inner inner core of the Earth: Texturing of iron crystals from three-dimensional seismic anisotropy. *Earth and Planetary Science Letters*, 269(1-2): 56-65, doi:10.1016/j.epsl.2008.01.049.
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The following is a list of friends and alumni of the Department of Geology provided by the University of Illinois Foundation, who have donated to the Department during the 2008 calendar year.

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